

SECTION 33 11 00

WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Water main pipe and fittings.
 - 2. Valves and boxes.
 - 3. Hydrants.
 - 4. Services.
 - 5. Insulation.
- B. Related Sections:
 - 1. Section 31 23 33 - Trench Excavation and Backfill
 - 2. Section 33 05 50 - Surface Facility Restoration
- C. Method of Measurement:
 - 1. Water Main:
 - a. Measure by distance in linear feet.
 - b. Measure along pipe axis with no deduction for fittings or valves.
 - c. Water Main includes bedding per Standard Detail Drawings.
 - d. Water Main includes polyethylene encasement.
 - e. Measure in the horizontal plane unless pipe grade exceeds 15 percent.
 - 2. Fittings:
 - a. Measure by weight in pounds.
 - b. Basis of Weight:
 - 1) Meet AWWA C 110 or C153.
 - 2) Exclude weights of glands, gaskets, rods, bolts, and other accessories.
 - 3. Valves and Boxes: Measure valve and box of each size and type as a unit.
 - 4. Hydrants:
 - a. Measure hydrants of each size and type as a unit.
 - b. Unit includes installation of hydrant, base, blocking, and crushed rock.
 - 5. Hydrant Extension: Measure by length in linear feet.
 - 6. Corporation Stops: Measure corporation stops of each size and type as a unit.
 - 7. Curb Stops and Boxes: Measure curb stops and boxes of each size and type as a unit.
 - 8. Service Pipe:
 - a. Measure by distance in linear feet.
 - b. Measure each size separately.
 - c. Measure from center of water main to center of curb stop plus 1-foot for slack.
 - 9. Insulation: Measure by volume in board feet.
 - 10. Relocation of Inplace Facilities: Measure as indicated in Contract Documents and Bid Form.
 - 11. Access Structures: Measure as indicated in Contract Documents and Bid Form.
- D. Basis of Payment:
 - 1. Payment for acceptable quantities of water main and appurtenances shall be at the Contract Unit Price as listed on the Bid Form. All associated work items shall be considered incidental.

1.02 REFERENCES

- A. ASTM:
 - 1. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - 2. A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - 3. A536 - Ductile Iron Castings
 - 4. A563 - Carbon and Alloy Steel Nuts
 - 5. B88 - Seamless Copper Water Tube
 - 6. B152 - Copper Sheet, Strip, Plate, Rolled Bar
 - 7. D429 - Tests for Rubber Adhesion to Rigid Surfaces
 - 8. D2842 - Tests for Water Absorption of Rigid Cellular Materials
 - 9. D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable
 - 10. F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs
 - 11. F594 - Stainless Steel Nuts

B. AWWA:

1. C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. C105 - Polyethylene Encasement for Ductile -Iron Pipe Systems
3. C110 - Ductile-Iron and Gray-Iron Fittings
4. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C150 - Thickness Design of Ductile Iron Pipe
6. C151 - Ductile-Iron Pipe, Centrifugally Cast for Water or other Liquids
7. C153 - Ductile-Iron Compact Fittings for Water Service
8. C502 - Dry-Barrel Fire Hydrants
9. C504 - Rubber-Seated Butterfly Valves
10. C509 - Resilient-Seated Gate Valves for Water Supply Service
11. C515 - Reduced-Wall, Resilient-Seated Gate Valves, for Water Supply Service
12. C600 - Installation of Ductile Iron Water Mains and their Appurtenances
13. C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
14. C651 – Disinfecting Water Mains
15. C800 – Underground Service Line Valves and Fittings
16. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for Water Distribution
17. C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ in. Through 3 in., for Water Service
18. C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. Through 48 in., (350 mm Through 1,200 mm), for Water Transmission and Distribution
19. C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 63 in., for Water Distribution
20. C907 – Polyvinyl Chloride (PVC) Pressure Fittings for Water – 4 in. Through 8 in. (100 mm Through 200 mm)

C. City of Richfield Municipal Code

1. Chapter 800 – work in the Right-of-Way

1.03 SUBMITTALS

- A. Submit Certificate of Compliance for products listed under Article 1.04.

- B. Submit a list of materials and suppliers for approval.
- C. Submit proposed method of joint conductivity.

1.04 QUALITY ASSURANCE

- A. Provide Certificates of Compliance from the manufacturer certifying that the following products meet the respective requirements listed in Article 1.02:
1. Water Main
 2. Fittings
 3. Valves & Boxes
 4. Hydrants
 5. Service Fittings
 6. Service Pipe
 7. Insulation

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inspection:
1. Inspect all pipe and products during the unloading process.
 2. Notify Engineer of any cracked, flawed or otherwise defective products.
 3. Remove all products found to be defective by the Engineer from the site.
- B. Handling and Storage: Handling and storage of products shall be in accordance with Section 2.2 of AWWA C600.

PART 2 PRODUCTS

2.01 WATER MAIN PIPE

- A. Ductile Iron: AWWA C151.
- B. Cement-Mortar Lining: AWWA C104.
- C. Thickness Class: 52, or as specified in Contract Documents.
- D. Joints: Push-On.
- E. Joint Conductivity:
1. Conductive gaskets as manufactured by American Ductile Iron Pipe Co.

2. Field Application Methods:
 - a. Burndy - Thermoweld by Burndy Corp., Norwalk, Connecticut.
 - b. Cadweld by Erico Products Co., Cleveland, Ohio.
3. Copper Jumpers:
 - a. Minimum 1/16-inch by 1/2-inch wide flat copper strip.
 - b. Annealed round copper wire conforming to ASTM B152, Type DHP.
4. Nuts and Bolts: Silicon Bronze.

2.02 FITTINGS

- A. Ductile Iron:
 1. 4 inch through and including 12 inch
 - a. AWWA C153
 2. Greater than 12 inch
 - a. AWWA C 110
- B. Cement-Mortar Lining: AWWA C104.
- C. Joints: Mechanical.
- D. Restrained Joint Retainer Glands:
 1. American, US Pipe, or Mega-Lug type.
 2. Ductile Iron
- E. Nuts and Bolts: Cor-Blue or approved equal.
- F. Threaded Metal Tie Rods: Stainless Steel rods and nuts. Treated after installation with asphaltic rustproofing.

2.03 VALVES AND BOXES

- A. Gate Valves:
 1. Resilient Seated: AWWA C515.
 2. Working Pressure: 200 psi.
 3. Ends: Mechanical Joint.
 4. Operating Stem: Non-Rising with O-ring Seals.
 5. Operating Nut: 2-inch Square, Open Left.
 6. Markings to be cast on the bonnet or body:
 - a. Open indicating arrow.
 - b. Manufacturer's name.
 - c. Pressure rating.
 - d. Year of manufacture.
 - e. Size.

- B. Butterfly Valves:
 1. Rubber Seated: AWWA C504.
 2. Class: 150B.
 3. Body Type: Mechanical - Joint-End.
 4. Disc:
 - a. 316 stainless steel edge
 - b. 3-inch thru 24-inch: ASTM A126 Class B Cast Iron
 - c. 30-inch and larger: ASTM A536 Ductile Iron
 5. Seat:
 - a. 3-inch through 20-inch: Bond to body per ASTM D429, Method B.
 - b. 24-inch and larger: Retain in body without use of metal retainers.
 6. Operator:
 - a. Traveling nut actuator
 - b. Open left.
 7. Markings to be cast on the body:
 - a. Open indicating arrow.
 - b. Manufacturer's name.
 - c. Class.
 - d. Year of manufacture.
 - e. Size.
- C. Boxes:
 1. Tyler Series 6860 with cover labeled "Water", or approved equal
 2. Cast Iron, 5-1/4-inch shaft.
 3. Vertical, 3 piece, Buffalo type.
 4. Box length to provide for 8 feet of pipe cover.
 5. Adjustable to 6 inches up or down from standard box length.

2.04 HYDRANTS

- A. Dry Barrel: AWWA C502.
- B. Waterous Pacer WB67-250 or equal.
- C. Hose Connections: 2 each at 2-1/2-inch diameter.
- D. Pumper Connection: 1 each at 4-inch diameter, Storz.
- E. Threads: National Standard.
- F. Operating Stem: Open Left with O-ring Seals.
- G. Traffic flange.

- H. Hub: 6-inch Mechanical Joint.
- I. Bolts and Nuts: ASTM F593 and F594 type 304 Stainless Steel
- J. Main Valve Opening: 5 -inch diameter.
- K. Valve: Faced with specially processed valve rubber with tapered seat for positive closure. Entire mechanism shall be removed for repairs or replacement through the barrel without excavating.
- L. Barrel Diameter: 5-inch.
- M. Outlet Nipples: Bronze, securely fastened into nozzle section. Hose and steamer caps shall be provided with rubber gaskets.
- N. Drain to operate only when hydrant is closed. Omit or plug drain only if specified in Contract Documents.
- O. In areas where hydrant base is installed below the ground water, the drain holes shall be plugged and the hydrant marked with a metal tag to indicate the requirement to pump the hydrant after use.
- P. Bury Depth: 8 feet-6 inches (ground to bottom of hub) unless otherwise specified in Contract Documents.
- Q. Minimum Nozzle Height (from flange): 22 inches.
- R. Cap Nuts: Pentagon.
- S. Color: Factory Red.
- T. Provide permanent markings which indicate:
 - 1. Manufacturer's name.
 - 2. Year of manufacture.
 - 3. Bury depth.
- U. Provide the following upon request by Engineer:
 - 1. Detailed drawings
 - 2. Catalog information
 - 3. Maintenance Data
- V. Accessories:
 - 1. Hydra-Finders (red and white).

2.05 TAPPING SLEEVE:

- 1. Ford – Fast Tap, JCM Model 432 Stainless Steel Tapping Sleeve, or approved equal.
- 2. Stainless steel.
- 3. Mechanical joint outlet for connection to tapping valve.

2.06 SERVICE PIPE

- A. Copper: ASTM B88.
- B. Type: K, Soft.

2.07 BRASS FITTINGS

- A. All fittings shall conform to ANSI/AWWA Standard C800, latest version.
- B. All brass components in contact with potable water must be made from either CDA/UNS Brass Alloys C89520 or C89833 with a maximum lead content of 0.25% by weight. Brass alloys not listed in ANSI/AWWA C800 Paragraph 4.1.2 are not approved. Brass Saddles shall be made from CDA/UNS C83600.
- C. All service fittings shall be certified as suitable for contact with drinking water by an ANSI accredited organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components – Health Effects.
- D. All fittings shall be stamped or embossed with a mark or name indicating that the product is manufactured from the low-lead alloy as specified in paragraph 4.

2.08 CORPORATION STOPS

- A. Type: A.Y. McDonald 4701B, or equal.
 - 1. Inlet: AWWA taper thread.
 - 2. Outlet: Copper flare straight connection.

2.09 CURB STOPS AND BOXES

- A. Valve:
 - 1. Type: A.Y. McDonald 6104B, or equal.
 - a. Inlet: flared Copper Service Thread.
 - b. Outlet: flared Copper Service Thread.

- B. Box:
 1. A.Y. McDonald 5627, or approved equal.
 2. Type: Minneapolis Pattern, Extension.
 3. Length: 8 feet.
 4. Adjustable to 6 inches up or down from specified length.
 5. **No** stationary rods.

- C. Casting:
 1. McDonald Type A – 674MA Series (4" bury depth) recessed cover frame.
 2. Install at all locations where curb stop box is in driveway, sidewalk, or parking areas.

2.10 INSULATION

- A. Rigid, extruded polystyrene board insulation.
- B. Thermal Resistance (R): 5.0.
- C. Thickness: 2-inch.
- D. Board Size: 48-inch by 96-inch.
- E. Compressive Strength: Minimum 25 psi.
- F. Water Absorption in accordance with ASTM D2842: 0.1 percent by volume, maximum.
- G. Edges: Square.

2.11 ENCASEMENT

- A. Polyethylene Sheet: AWWA C105 Low Density
- B. Thickness: 8 mil

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. Connection to Existing System: Provide **48 hours** notice to Engineer and City Utilities Division prior to disturbing any water service. Contractor shall deliver **written 48 hour advance notice** to any residents who will be affected by the shutting off of water.
 1. Pressure Tap:
 - a. Install tap in location shown on the Drawings.
 - b. Expose water main sufficiently to facilitate the connection.
 - c. Use approved tapping machine designed specifically for tapping under pressure.
 - d. Install tapping sleeve and gate valve as part of assembly.
 - e. Install blocking as required.
 2. Cut-In Connection:
 - a. Isolate segment of pipe to be cut and drain water from the line.
 - b. Take every precaution necessary to prevent dirt or debris from entering existing lines.
 - c. Connect tee and sleeve assembly to pipe ends.
 - d. Install blocking as required.
 3. Connect to Inplace Fitting:
 - a. Isolate segment of inplace pipe and remove blocking as required.
 - b. Take every precaution necessary to prevent dirt or debris from entering existing lines.
 - c. Remove plug and drain water from the line.
 - d. Install blocking as required.
- B. Work shall not commence before 7:00 a.m. nor extend beyond 10:00 p.m. Monday thru Friday. On Saturdays, work hours are from 8:00 a.m. to 6:00 p.m. No work is permitted on Sundays or Holidays unless authorized by the City of Richfield. The definition of "work" also includes the starting of equipment and the delivery of materials to the job site.
- C. Pipe Installation:
 1. Install pipe at the alignment and grade shown on the Drawings.

2. Provide a minimum of 7.5 feet of cover over the pipe.
3. Install appurtenances in the locations shown on the Drawings.
4. Remove all dirt and foreign material from the pipe interior prior to installation.
5. See Section 31 23 33 for pipe foundation and backfill procedures.
6. See Section 31 23 33 in case of conflicts with existing pipes.
7. Install watertight plugs in all open ends of the pipe line when pipe laying is not in progress, including noon hour and overnight periods.

D. Valve and Box Installation:

1. Verify that subgrade material is adequate to support valve assembly.
2. Install valves with stems vertical and plumb.
3. Install boxes plumb and centered over the valve nut.
4. Verify that box remains plumb and centered during backfill.
5. Adjust box cover to required grade.

E. Hydrant Installation:

1. Verify that subgrade material is adequate to support hydrant.
2. Place thrust block, crushed rock and plastic sheeting in accordance with Drawing details.
3. Install and maintain hydrant in a plumb position.
4. Where groundwater is present, plug drain hole and affix "Pump After Use" tag to the hydrant.

F. Joint Conductivity:

1. Provide electrical bond across all joints between pipes and appurtenances.
2. Install copper jumpers by either shop or field applications.
3. Fasten multiple jumper strips with silicon bronze bolts and nuts.
4. Welding:
 - a. Grind surfaces to be welded to remove coating and oxide and to provide clean metal surface.
 - b. Use metallic-arc process for shop applications.
 - c. Use exothermic process for field applications.

- d. Refinish welded area with protective coating after connection is made.

G. Thrust Restraint:

1. Install thrust restraints at all bends, tees and plugs.
2. Concrete Blocking:
 - a. Place between the fitting and undisturbed trench wall.
 - b. Minimum thickness: 12 inches.
 - c. Minimum area in square feet shall be in accordance with the following:

Pipe	Tee or Plug	1/4 Bend	1/32 and 1/8 Bend	1/16 Bend
6-inch	2.9	3.1	1.6	0.8
8-inch	3.7	5.3	2.9	1.4
10-inch	5.7	8.1	4.4	2.2
12-inch	8.1	13.4	6.6	3.2
16-inch	15.1	21.4	11.6	5.9
20-inch	23.2	30.2	18.1	9.3
24-inch	33.6	48.5	26.1	13.3

- d. Size blocking based on the larger main.
- e. Verify that bolts are accessible after concrete is poured.
3. Timber Blocking:
 - a. Shall not be used.
4. Restrained Joints:
 - a. Submit method and type to Engineer for approval.
 - b. Install in accordance with "Thrust Restraint Design for Ductile Iron Pipe".

H. Service Installation: Contractor shall keep accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Complete records shall be submitted by the Contractor to the Engineer upon completion of the work.

1. Corporation Stops:
 - a. Provide watertight connection with approved tapping machine.
 - b. Install under main pressure.
 - c. Place a double wrap of Teflon tape around the threads prior to installation.
2. Copper Service Pipe:
 - a. Install pipe between corporation stop and curb stop with no joints or unions.

- b. Flare copper tubing ends with proper size and type of tools as designated for the purpose.
 - c. Bury Depth: 8 feet.
 - d. Provide minimum 1-foot of slack in the pipe to allow for settlement and movement.
 - e. Install service pipe at right angles to water main or property line, a minimum of 4 feet from sanitary sewer services, and 10 feet away from all other sewer services.
3. Curb Stop and Box:
- a. Install at the location shown on the Drawings.
 - b. Install one-foot length of copper service line on the outlet side of the curb stop. Stub end shall be pinched closed to prevent partial intrusion.
 - c. Verify that subgrade material is adequate to support the curb box assembly.
 - d. Install boxes plumb and centered over the tee head.
 - e. Verify that box remains plumb and properly aligned during backfill.
 - f. Adjust box cover to required grade.
 - g. Key all curb stops after backfill to ensure proper operation.
 - h. Mark curb stops and service ends as specified in Contract Documents.

I. Encasement:

- 1. Comply with AWWA C105.
- 2. Wrap all pipe and fittings in the location shown on the Drawings.
- 3. Clean all surfaces of pipe and appurtenances prior to wrapping.
- 4. Provide sufficient slack to prevent damage during backfill.
- 5. Provide minimum 6-inch overlap at joints.
- 6. Secure overlap and joints with compatible adhesive tape.
- 7. Repair damaged wrap with tape or polyethylene patch.

3.02 FIELD QUALITY CONTROL

- A. Perform the following tests upon completion of the system, after all blocking has reached design strength and prior to being placed into service:

1. Pressure and Leakage Test:

- a. Perform pressure and leakage test in accordance with AWWA C600.
- b. Test Pressure: 150 psi.
- c. Test Duration: 2 hours.
- d. Gage Requirements:
 - 1) Size: 4-1/2-inch dial.
 - 2) Range: 0 to 200 psi.
 - 3) Gradation: 2 psi.
 - 4) Accuracy: 1/2 percent.
- e. Do not allow pressure to vary more than 5 psi during the test.
- f. Do not allow pressure to vary more than 2 psi during the last hour of the test.
- g. Allowable Leakage: One-half of the volume allowed by AWWA C600 in accordance with the following:

$$L = \frac{SD}{266,400} P$$

$$L = \text{Allowable Leakage in Gallons Per Hour}$$

$$S = \text{Length of Pipe Tested in Feet}$$

$$D = \text{Nominal Diameter of Pipe in Inches}$$

$$P = \text{Average Test Pressure During Test in Pounds/ Square Inch (Gage)}$$

2. Testing Services:

- a. Perform separate pressure and leakage test on the services with the corporation stops open.
- b. Test Pressure: 100 psi.
- c. Allowable Leakage: None.
- d. At Contractor's option, service testing may be done concurrent with main testing.

3. Electrical Conductivity Test:

- a. Perform electrical conductivity test to verify that electrical thawing of the system may be accomplished by Owner.

- b. Test Parameters:
 - 1) Perform test within 1 week after pressure testing.
 - 2) Perform test after back-filling is completed and while line is at normal operating pressure.
 - 3) Test Current: 350 amperes DC plus or minus 10 percent.
 - 4) Test Duration: 5 minutes.
 - 5) Test between hydrants in segments of convenient length.
- c. Procedures:
 - 1) Furnish DC current source, cable and all required equipment of adequate capacity to accomplish the test.
 - 2) Clamp cables to hydrant flange bolts.
 - 3) Conduct test with hydrant in the open position and caps on.
 - 4) Measure current continuously throughout the test with a DC ammeter hooked on a cable lead.
 - 5) Start test at minimum current level and increase to test level.
 - 6) Drain hydrant and tighten caps after test.
- d. Failure and Correction:
 - 1) Failure of a segment shall be determined by current measurements that are insufficient, intermittent or unsteady.
 - 2) Isolate and correct defective contact points as indicated by failed tests.
 - 3) Retest failed segments after correction.
- 4. Operational Inspection:
 - a. Upon completion of the project and in the presence of the Engineer and the Contractor, representatives of the City of Richfield shall:
 - 1) Operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order.
 - 2) Ensure that all valve boxes are centered and valves are opened.
 - 3) Ensure that all hydrants operate and drain properly.
 - 4) Ensure that all curb boxes are plumb and centered.
 - 5) Ensure that water is available at all curb stops.

3.03 DISINFECTION

- A. Disinfect all newly installed water mains, appurtenances and services in accordance with AWWA C651.
 - 1. Tablet or Continuous Feed Method:
 - a. Hold chlorine solution in pipe for a minimum period of 24 hours.
 - 1) Initial dosage: 50 ppm minimum.
 - 2) Residual dosage after hold period: 10 ppm minimum.
- B. Flush system within 24 hours after disinfection is completed.
- C. Sampling and Testing:
 - 1. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
 - 2. Each sample set shall include:
 - a. One sample for every 1,200 feet of main.
 - b. One sample at each dead-end.
 - c. Ensure that 1 sample is obtained from each branch of main.
 - d. Minimum sample required: 2
 - 3. Perform coliform tests on each sample.
 - 4. Rechlorinate if any sample tests positive for coliform.

END OF SECTION